Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims

1-20 (Canceled)

21. (New) A spatially-scalable video encoding apparatus comprising:

a decimate unit for performing DCT-based down-sampling with respect to macro block data of input video data to produce decimated block data representing low frequency part of the macro block data;

a first encoder for encoding the decimated block data to produce base layer DCT data having DCT coefficients representing the low frequency part;

a first decoder for decoding the base layer DCT data from the first encoder to produce base layer block data;

an interpolate unit for performing DCT-based interpolation with respect to the base layer block data from the first decoder to produce interpolated base layer block data;

a second encoder for encoding enhancement layer block data obtained from the macro block data and the interpolated base layer block data to produce enhancement layer DCT data, the enhancement layer block data representing high frequency part of the macro block data; and

a second decoder for decoding the enhancement layer DCT data from the second encoder to produce reconstructed macro block data,

wherein the decimate unit includes:

a first DCT unit for performing DCT with respect to an input block to produce a block of DCT coefficients;

a truncate unit for selecting a low frequency part of the block of DCT coefficients provided from the first DCT unit; and

a first IDCT unit for performing IDCT with respect to the low frequency part of the block of DCT coefficients selected by the truncate unit to produce an output block.

22. (New) The spatially-scalable video encoding apparatus of claim 21 wherein the output block has a size equal to a quarter of the input block.

23. (New) The spatially-scalable video encoding apparatus of claim 21 wherein the decimate unit performs vertical down-sampling with a first matrix and horizontal down-sampling with a second matrix with respect to the input block.

24. (New) A spatially-scalable video encoding apparatus comprising:

a decimate unit for performing DCT-based down-sampling with respect to macro block data of input video data to produce decimated block data representing low frequency part of the macro block data;

a first encoder for encoding the decimated block data to produce base layer DCT data having DCT coefficients representing the low frequency part;

a first decoder for decoding the base layer DCT data from the first encoder to produce base layer block data;

an interpolate unit for performing DCT-based interpolation with respect to the base layer block data from the first decoder to produce interpolated base layer block data;

a second encoder for encoding enhancement layer block data obtained from the macro block data and the interpolated base layer block data to produce enhancement layer DCT data, the enhancement layer block data representing high frequency part of the macro block data; and

a second decoder for decoding the enhancement layer DCT data from the second encoder to produce reconstructed macro block data,

wherein the first encoder includes a first motion compensate unit for compensating the decimated block data from the decimate unit with base layer data of a previous picture and motion vectors for the macro block data

to produce compensated base layer block data so that the first encoder performs DCT with respect to the compensated base layer block data to produce the base layer DCT data.

25. (New) The spatially-scalable video encoding apparatus of claim 24 wherein the first motion compensation unit includes:

a first select unit for selecting a block of pixels to be predicted from the base layer data of the previous picture using the motion vectors for the macro block data;

an interpolate unit for performing DCT-based interpolation with respect to the block of pixels to be predicted to produce full resolution prediction block data;

a second decimate unit for performing DCT-based down-sampling with respect to the full resolution prediction block data to produce base layer prediction block data; and

an adder for subtracting the base layer prediction block data from the decimated block data to obtain the compensated base layer block data.

26. (New) The spatially-scalable video encoding apparatus of claim 25 wherein the first motion compensation unit further includes a half-pixel interpolate unit for performing an interpolation with half-pixel accuracy with respect to the full resolution prediction block data, output data of the half-pixel interpolate unit being provided to the second decimate unit.

27. (New) A spatially-scalable video encoding apparatus comprising:

a decimate unit for performing DCT-based down-sampling with respect to macro block data of input video data to produce decimated block data representing low frequency part of the macro block data;

a first encoder for encoding the decimated block data to produce base layer DCT data having DCT coefficients representing the low frequency part;

a first decoder for decoding the base layer DCT data from the first encoder to produce base layer block data;

an interpolate unit for performing DCT-based interpolation with respect to the base layer block data from the first decoder to produce interpolated base layer block data;

a second encoder for encoding enhancement layer block data obtained from the macro block data and the interpolated base layer block data to produce enhancement layer DCT data, the enhancement layer block data representing high frequency part of the macro block data; and

a second decoder for decoding the enhancement layer DCT data from the second encoder to produce reconstructed macro block data,

wherein the interpolate unit includes:

a second DCT unit for converting an input block into a first block of DCT coefficients;

a zero pad unit for padding the first block of DCT coefficients with zeros to produce a second block of DCT coefficients; and

a second IDCT unit for performing IDCT with respect to the second block of DCT coefficients to produce an output block.

28. (New) The spatially-scalable video encoding apparatus of claim 27 wherein the input block has a size equal to a quarter of the output block.

29. (New) The spatially-scalable video encoding apparatus of claim 27 wherein the interpolate unit performs vertical up-sampling with a third matrix and horizontal up-sampling with a fourth matrix with respect to the input block.

30. (New) A spatially-scalable video encoding apparatus comprising:

a decimate unit for performing DCT-based down-sampling with respect to macro block data of input video data to produce decimated block data representing low frequency part of the macro block data;

a first encoder for encoding the decimated block data to produce base layer DCT data having DCT coefficients representing the low frequency part;

a first decoder for decoding the base layer DCT data from the first encoder to produce base layer block data;

an interpolate unit for performing DCT-based interpolation with respect to the base layer block data from the first decoder to produce interpolated base layer block data;

a second encoder for encoding enhancement layer block data obtained from the macro block data and the interpolated base layer block data to produce enhancement layer DCT data, the enhancement layer block data representing high frequency part of the macro block data; and

a second decoder for decoding the enhancement layer DCT data from the second encoder to produce reconstructed macro block data,

wherein the second encoder has a second motion compensation unit for compensating the enhancement layer block data with enhancement layer data of a previous picture and motion vectors for the macro block data to produce compensated enhancement layer block data so that the second encoder performs DCT with respect to the compensated enhancement layer block data to produce the enhancement layer DCT data.

31. (New) The spatially-scalable video encoding apparatus of claim 30 wherein the second motion compensation unit includes:

a second select unit for selecting a block of pixels to be predicted from the enhancement layer data of the previous picture using the motion vectors for the macro block data;

a third DCT unit for performing DCT with respect to the block of pixels to be predicted to produce a block of DCT coefficients;

a low frequency remove unit for removing low frequency contents of the block of DCT coefficients;

a third IDCT for performing IDCT with respect to output data of the low frequency remove unit to obtain enhancement layer prediction block data; and

an adder for subtracting the enhancement layer prediction block data from the enhancement layer block data to obtain the compensated enhancement layer block data.

32. (New) The spatially-scalable video encoding apparatus of claim 31 wherein the low frequency remove unit removes the low frequency contents by setting low frequency DCT coefficients to zero.

33. (New) A method for performing spatially-scalable video encoding operations comprising:

decimating macro block data of input video data by performing DCT-based down-sampling to obtain decimated block data representing low frequency part of the macro block data;

encoding the decimated block data to obtain base layer DCT data having DCT coefficients representing the low frequency part;

decoding the base layer DCT data to obtain base layer block data;

interpolating the base layer block data by performing DCT-based up-sampling with respect to the base layer block data to produce interpolated base layer block data;

subtracting the interpolated base layer block data from the macro block data to obtain enhancement layer block data representing high frequency part of the macro block data;

encoding the enhancement layer block data to obtain enhancement layer DCT data; and

decoding the enhancement layer DCT data to obtain reconstructed macro block data,

wherein the decimating step includes the steps of:

performing DCT with respect to an input block of the macro block data to produce a block of DCT coefficients;

truncating the block of DCT coefficients by selecting a low frequency part of the block of DCT coefficients; and

performing IDCT with respect to the low frequency part of the block of DCT coefficients to produce the decimated block data.

34. (New) The method of claim 33, wherein the encoding the decimated block data step includes performing motion compensation of the decimated block data, the motion compensation including the steps of:

selecting a block of pixels to be predicted from base layer data of a previous picture using motion vectors for the macro block data;

performing DCT-based interpolation with respect to the block of pixels to be predicted to produce full resolution prediction block data;

decimating the full resolution prediction block data by performing DCT-based down-sampling to produce base layer prediction block data; and

subtracting the base layer prediction block data from the decimated block data to obtain compensated base layer block data which is subject to DCT to produce the base layer DCT data.

35. (New) The method of claim 33, wherein the interpolating step includes the steps of:

performing DCT with respect to an input block to obtain a first block of DCT coefficients;

padding the first block of DCT coefficients with zeros to produce a second block of DCT coefficients; and

performing IDCT with respect to the second block of DCT coefficients to obtain the interpolated base layer block data.

36. (New) The method of claim 33, wherein the encoding the enhancement layer block data step includes performing motion compensation of the enhancement layer block data, the motion compensation includes the steps of:

selecting a block of pixels to be predicted from enhancement layer data of a previous picture using motion vectors for the macro block data;

performing DCT with respect to the block of pixels to be predicted to produce a block of DCT coefficients;

removing low frequency contents of the block of DCT coefficients;

performing IDCT with respect to the DCT coefficients in which the low frequency contents are removed, to obtain enhancement layer prediction block data; and

subtracting the enhancement layer prediction block data from the enhancement layer block data to obtain compensated enhancement layer block data which is subject to DCT to produce the enhancement layer DCT data.